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(54) **FUSING DEVICE AND IMAGE FORMING APPARATUS EMPLOYING THE SAME**

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(51) **Int. Cl.**
G03G 15/20 (2006.01)

(52) **U.S. Cl.** **399/329**; 399/122; 399/320; 399/330

(58) **Field of Classification Search** 399/122, 399/329, 330, 331, 333
See application file for complete search history.

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(57) **ABSTRACT**

Disclosed are a fusing device and an image forming apparatus employing the fusing device. The fusing device includes a belt having a closed loop configuration, a first roller rotatably disposed inside the loop defined by belt. The first roller includes heat absorbent layer. The fusing device further includes a second roller rotatably disposed outside the loop of the belt, the first and second rollers each make pressing contact with the portion of the belt that passes between them to form the fusing nip. The heat absorbent layer of the first roller provides heat for the fusing nip.

24 Claims, 6 Drawing Sheets

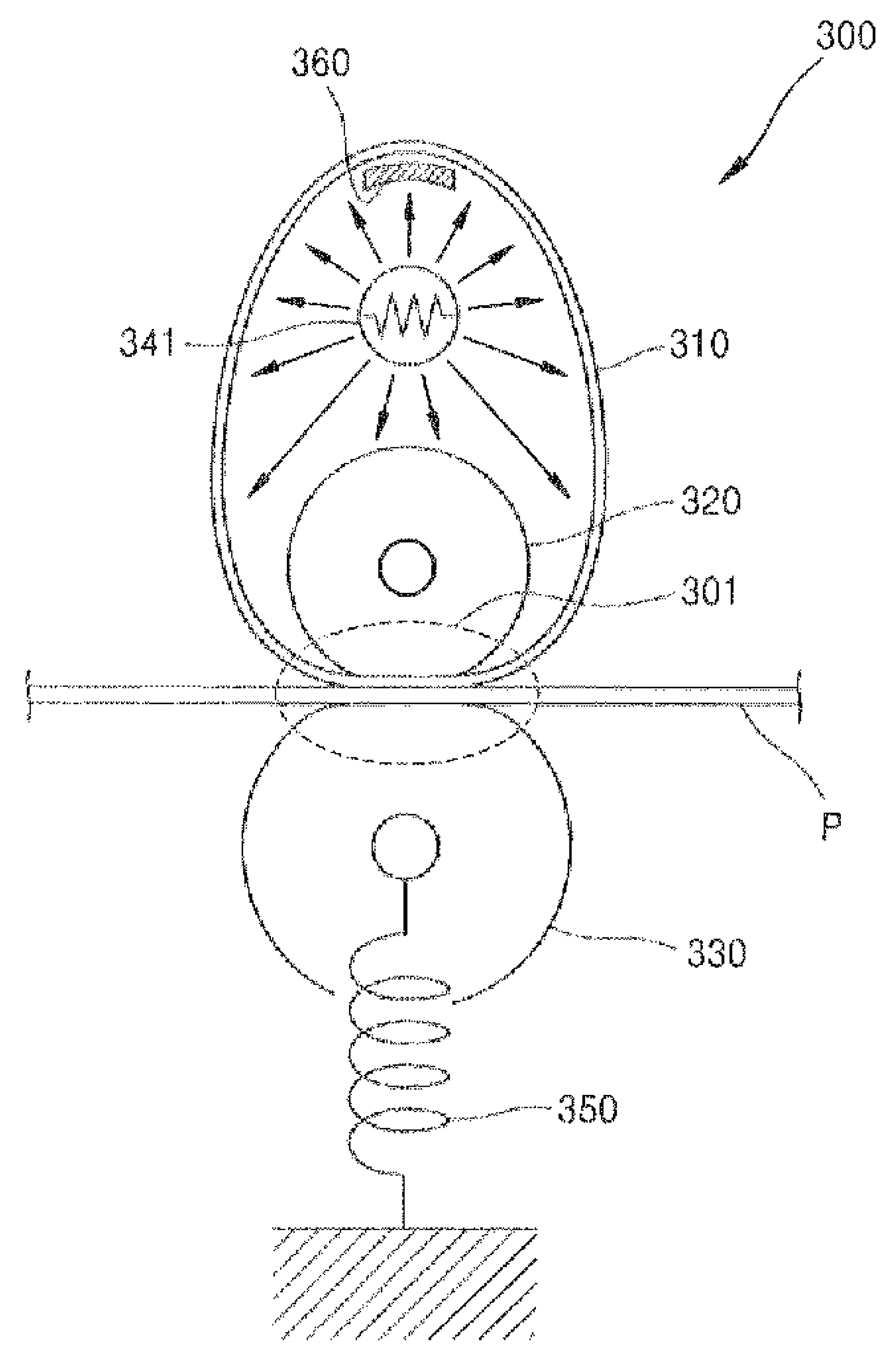
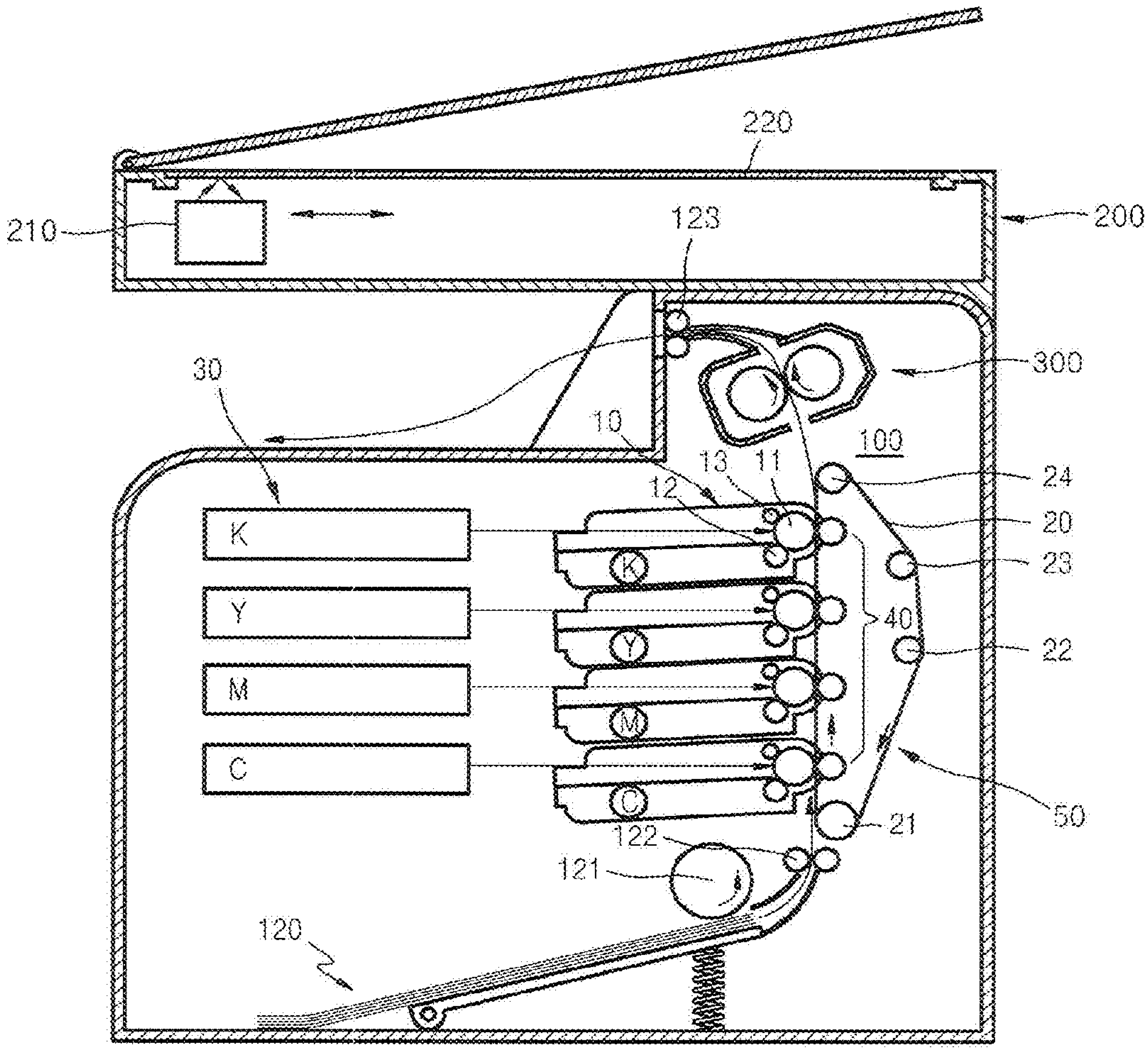


FIG. 1



220
210
200
123
300
30
10
100
13
11
24
12
20
K
23
Y
40
22
M
C
50
122
21
121
120

FIG. 2

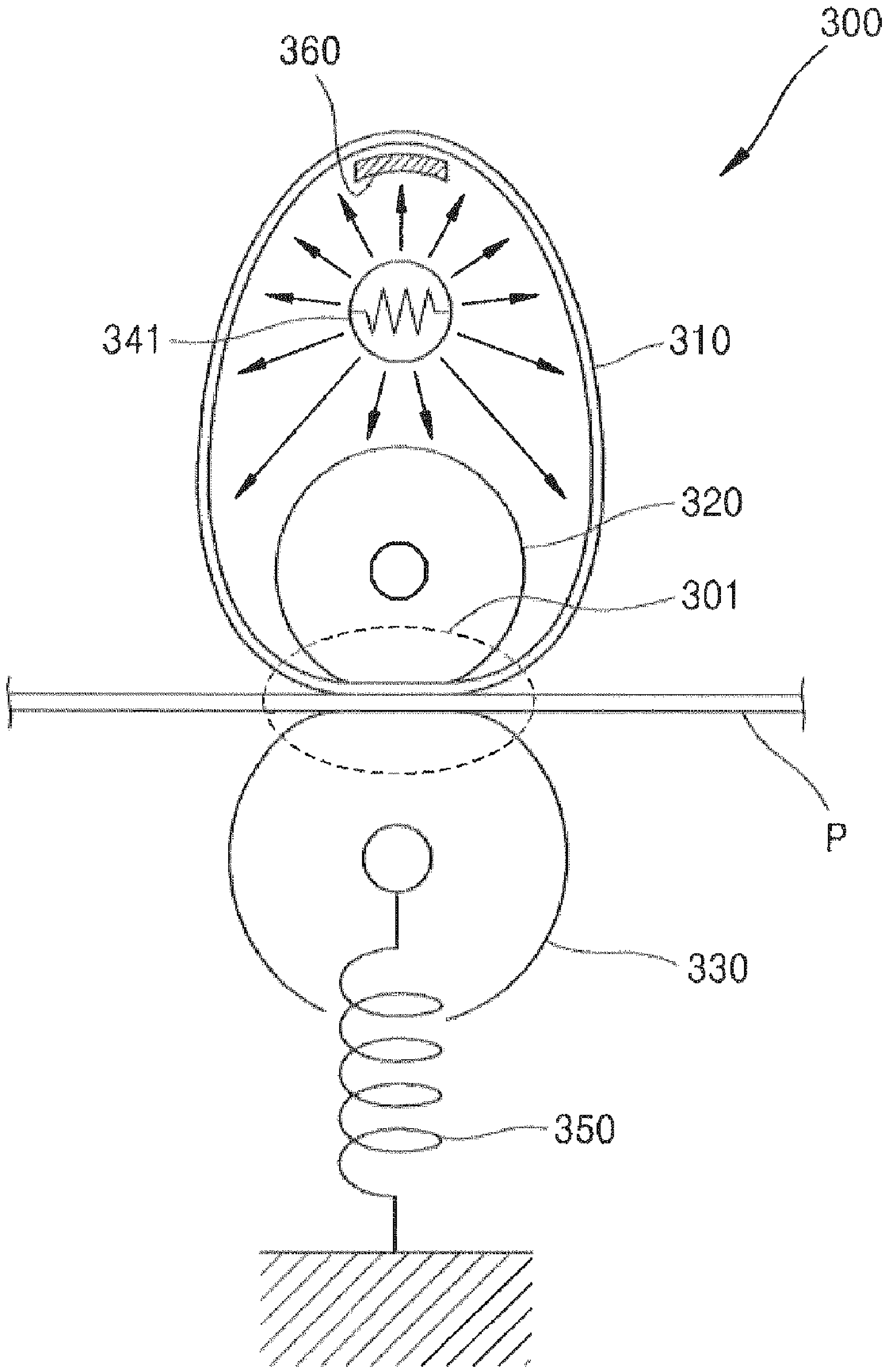

300
360
341
310
320
301
P
330
350

FIG. 3

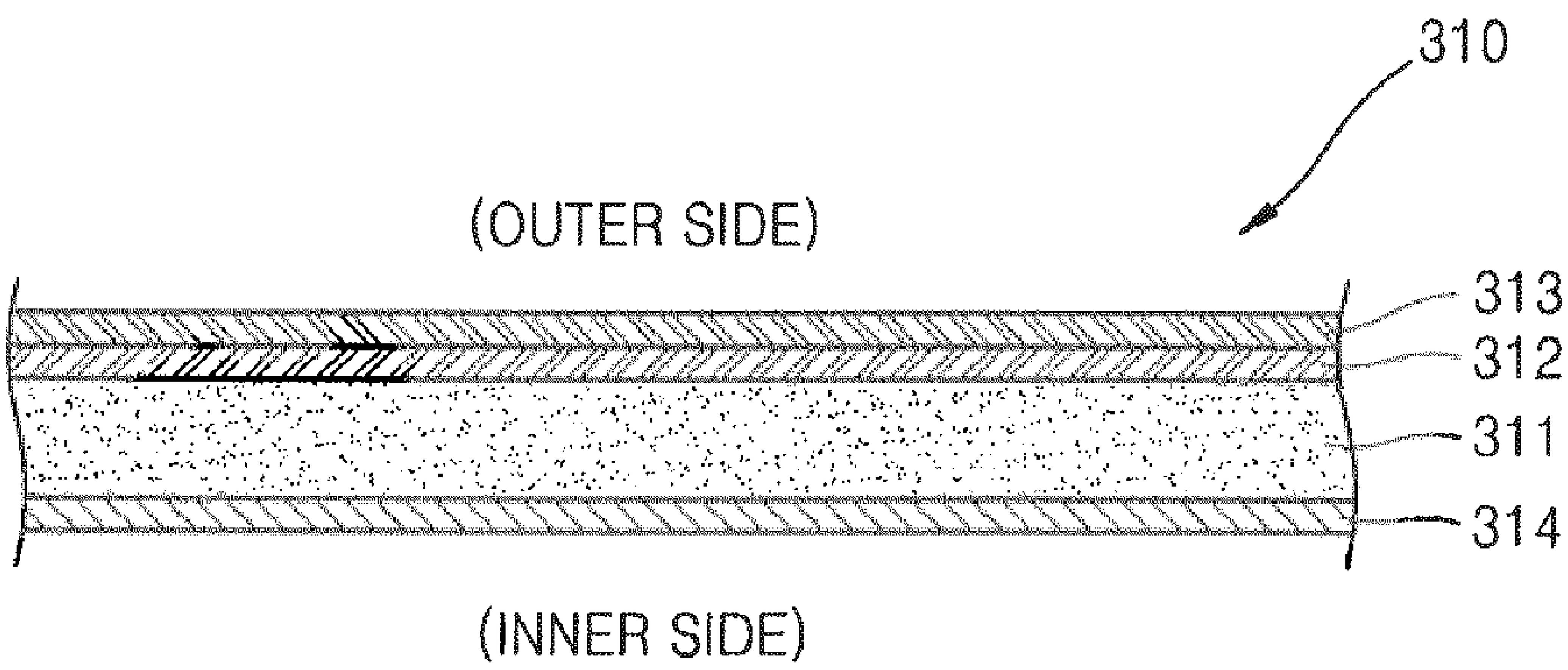

310
(OUTER SIDE)
313
312
311
314
(INNER SIDE)

FIG. 4

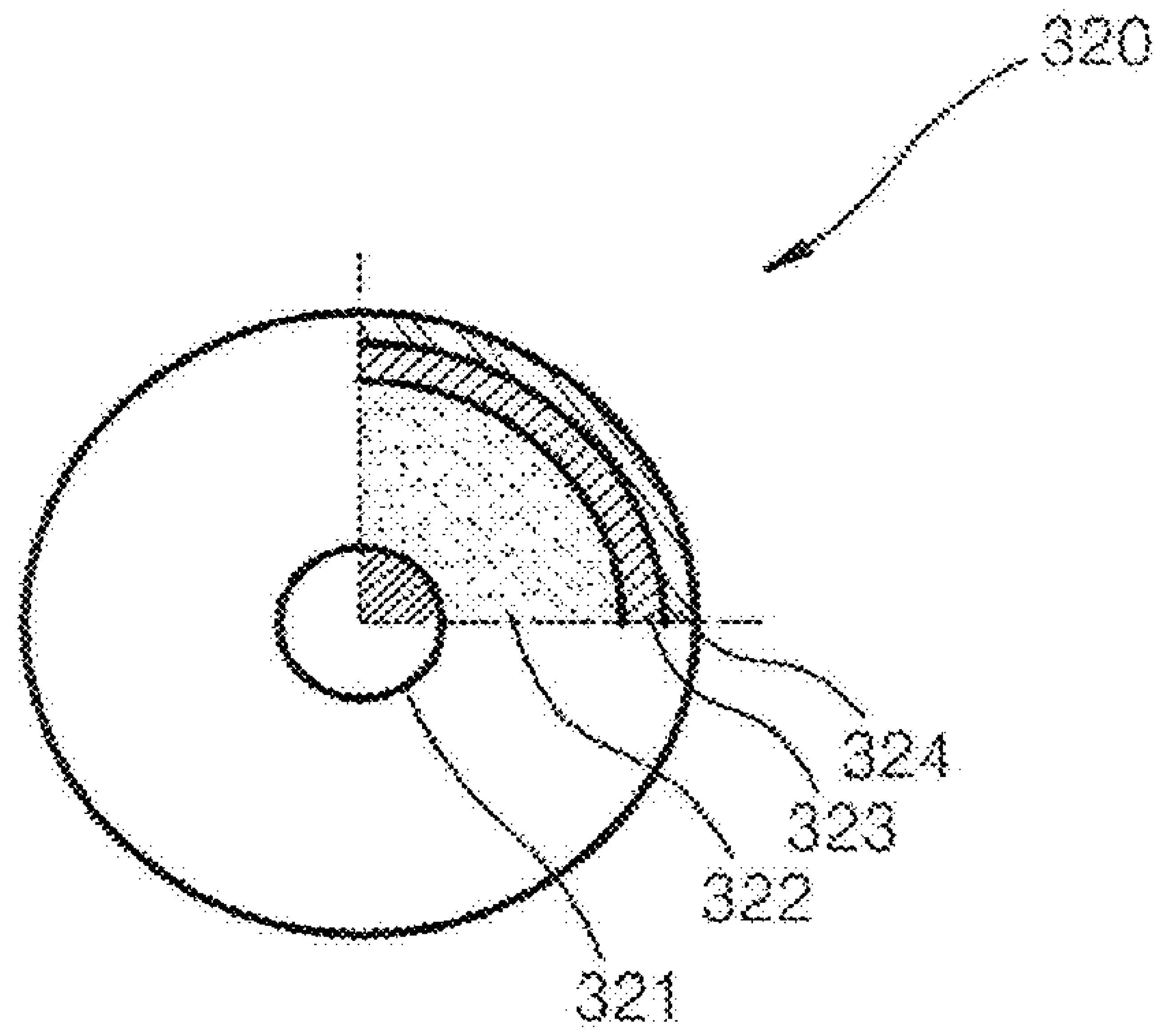


FIG. 5

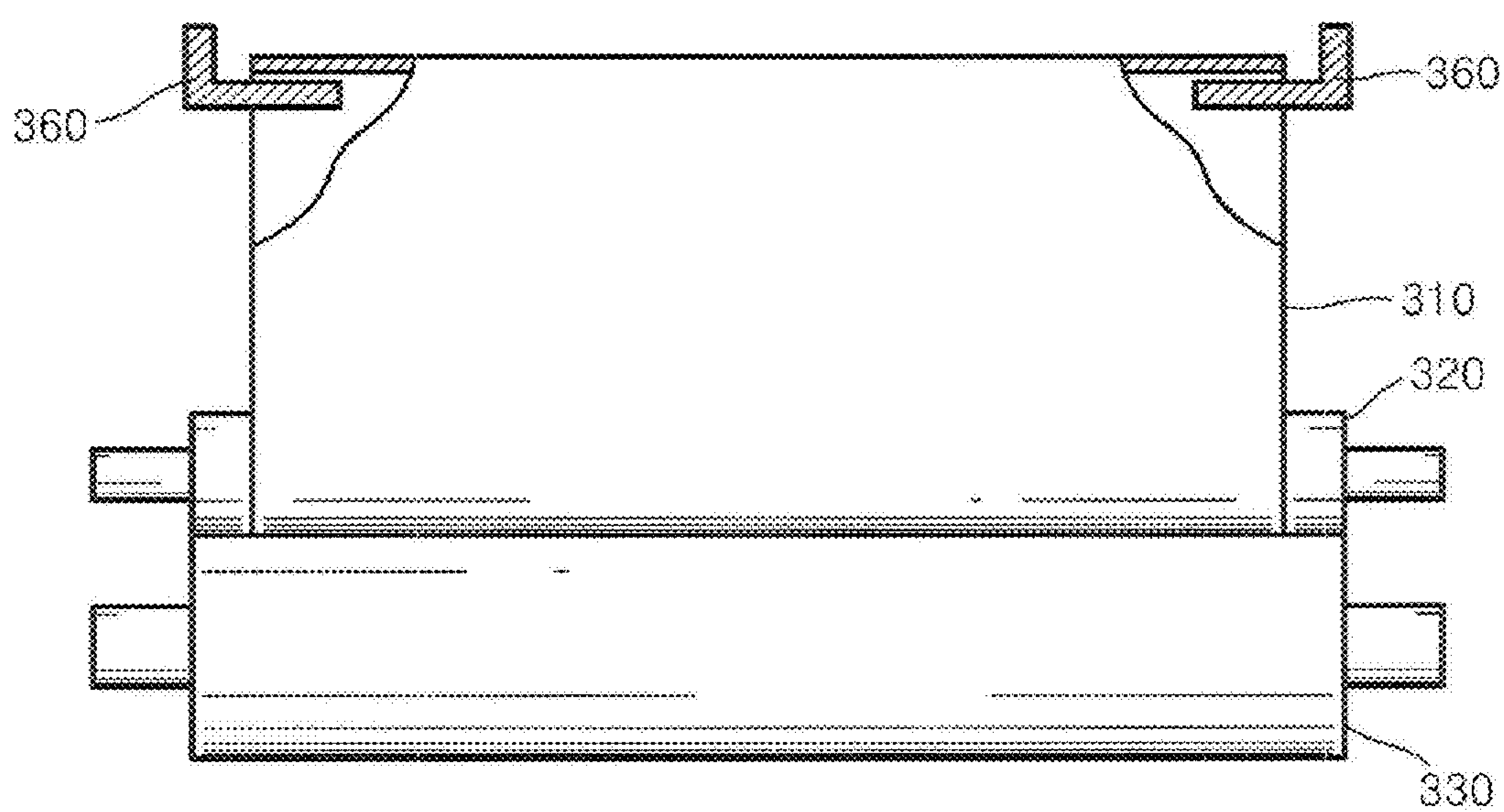


FIG. 6

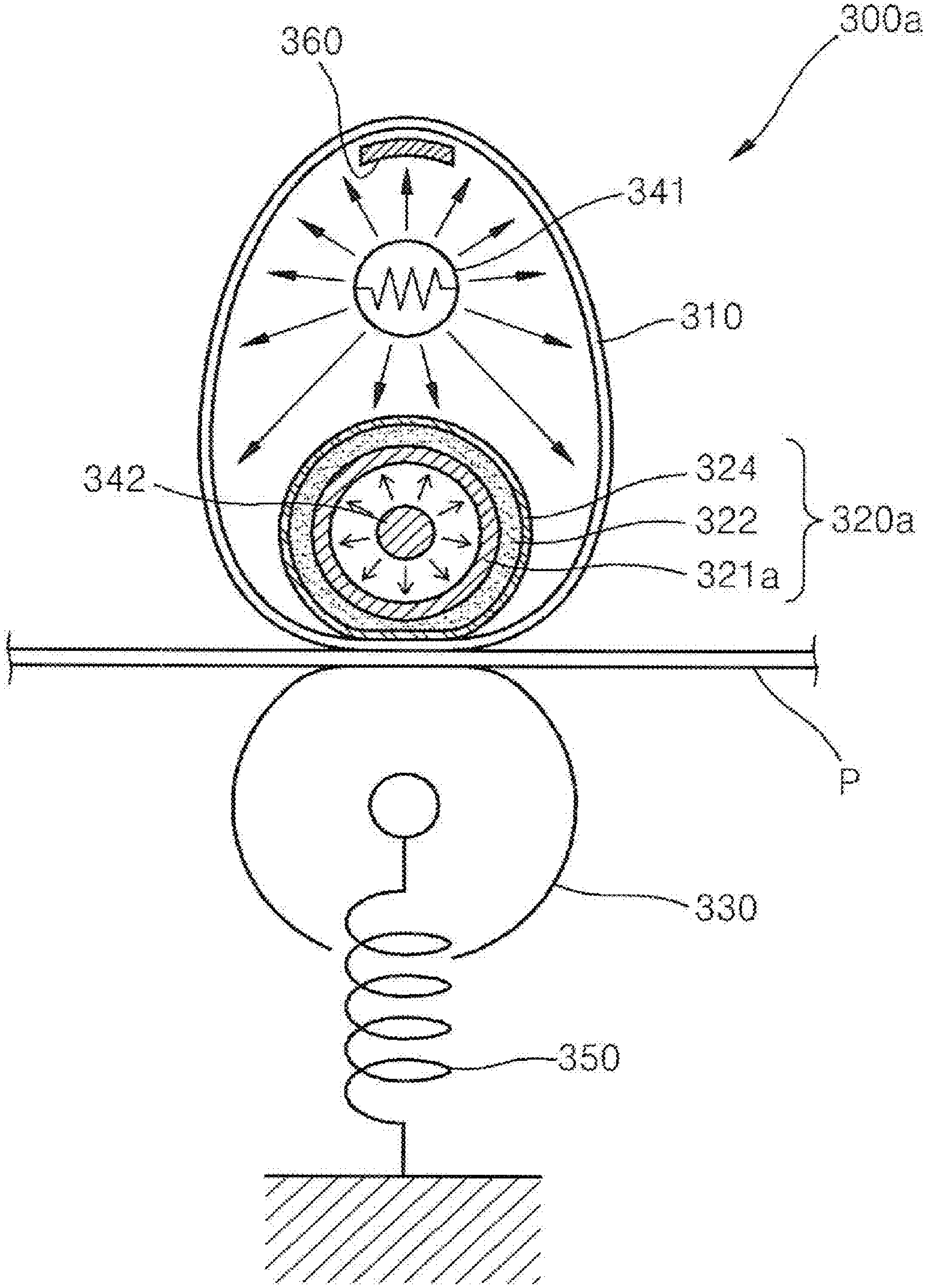


FIG. 7

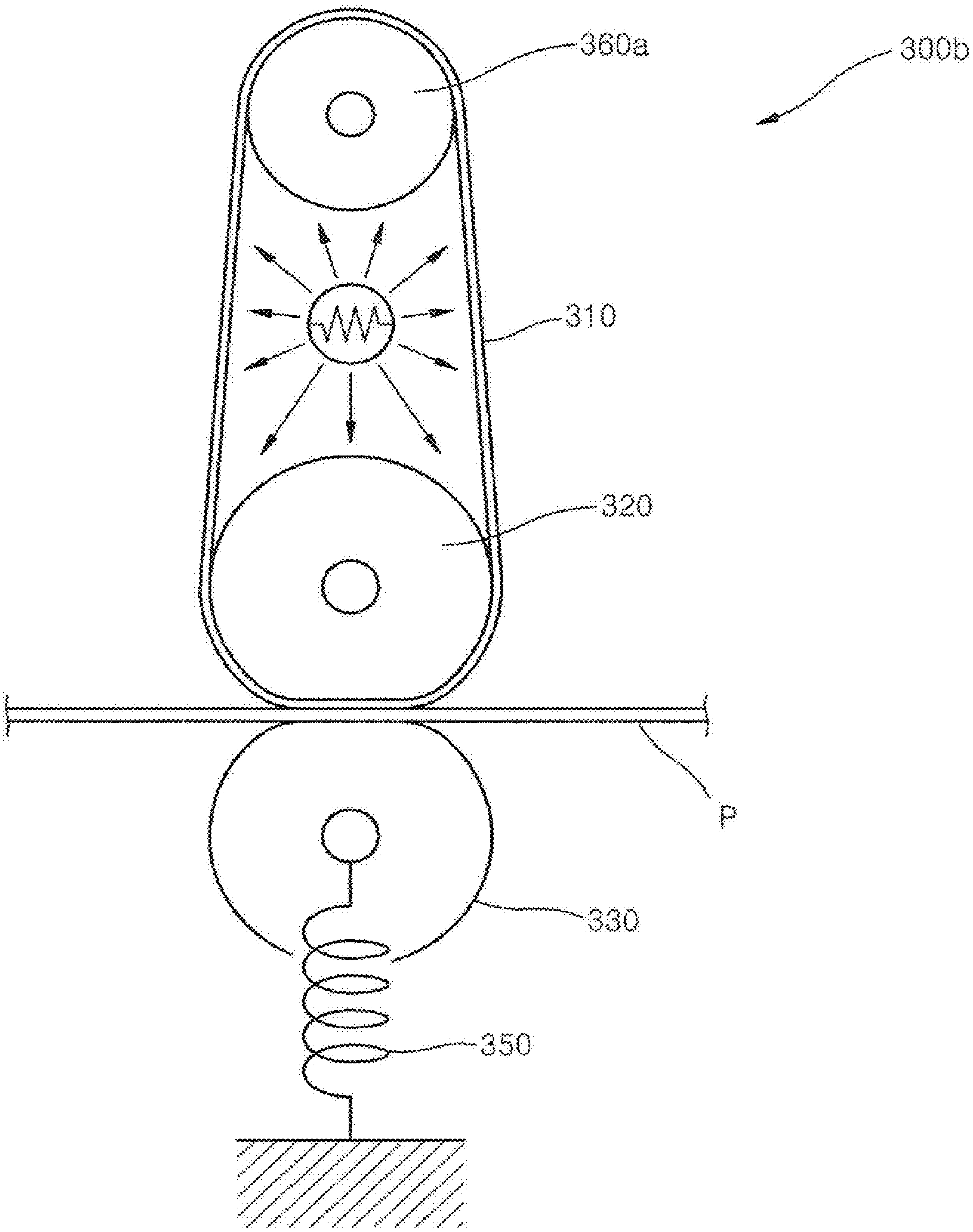
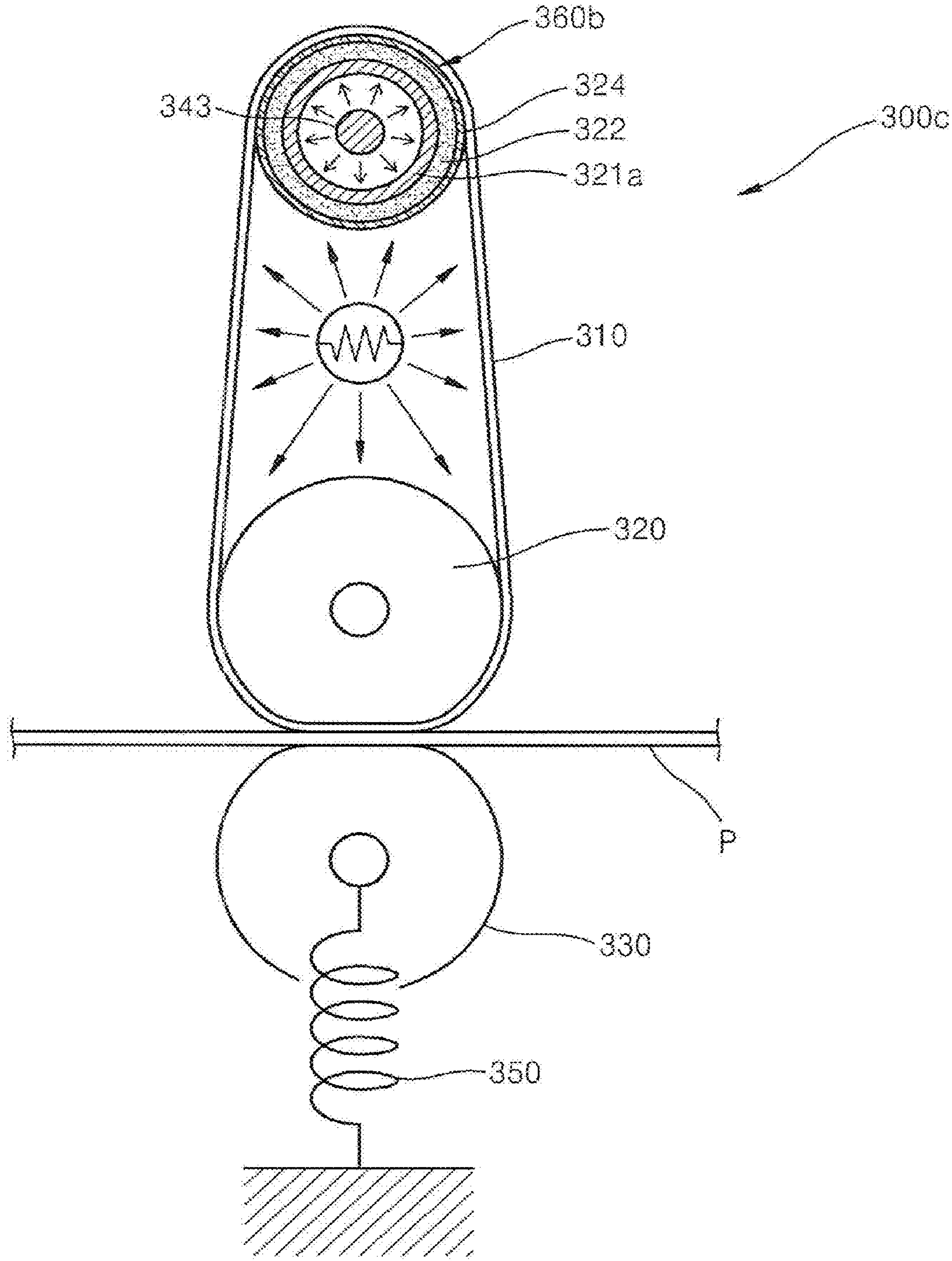


FIG. 8



FUSING DEVICE AND IMAGE FORMING APPARATUS EMPLOYING THE SAME

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

This application claims the benefit of U.S. Patent Application No. 61/106,702, filed on Oct. 20, 2008, in the United States Patent and Trademark Office, and Korean Patent Application No. 10-2008-0134952, filed on Dec. 26, 2008, in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

The present disclosure relates to a fusing device for fusing a toner image to a recording medium by applying heat and pressure, and an image forming apparatus employing the same.

BACKGROUND OF RELATED ART

In general, an image forming apparatus is a peripheral device that may have the functionality of a copier, a printer, and/or a facsimile, for example, and which is capable of printing an image on a printing medium. Such an image forming apparatus can include an image forming unit and a fusing device. The image forming unit can include a photosensitive medium on which an electrostatic latent image can be formed, and a developing unit configured to develop the electrostatic latent image by using a developing agent. After the developed image is transferred to a printing medium, the fusing device can fuse the developed image to the printing medium by applying heat and pressure.

The fusing device can include a heat roller having a lamp heater and a pressure roller that is engaged with the heat roller to form a fusing nip. In the above-structured fusing device, because the thermal capacity of the heat roller can be high and all surfaces of the heat roller are heated, heating the fusing device to a predetermined fusing temperature may take a relatively long time. Moreover, the fusing nip is formed where the heat roller and the pressure roller are engaged with each other, and thus, the fusing nip has a relatively narrow width.

SUMMARY OF THE DISCLOSURE

According to an aspect of the present disclosure, a fusing device may be provided to include a belt having a closed loop configuration; a first roller rotatably disposed inside a loop defined by the belt, the first roller having a metallic layer formed on an outer circumferential surface thereof; a second roller rotatably disposed outside the loop, the first and second rollers each being in a pressing contact with a portion of the belt that passes therebetween; and a first heat source disposed inside the belt.

The first roller may include a core and an elastic layer formed over the core, the metallic layer of the first roller being formed over the elastic layer.

The first roller may further includes an insulating layer formed between the elastic layer and the metallic layer.

The core of the first roller may have a hollow inner portion. The fusing device may further comprise a second heat source disposed inside the hollow inner portion of the core.

The belt may include a substrate and an elastic layer formed over a first side of the substrate. The substrate may include a metallic layer.

The belt may include a coating layer formed over a second side opposite the first side of the substrate of the belt. The coating layer may be heat absorbent.

The belt may include a separation layer formed over the elastic layer. The separation layer may promote separation of the belt from a printing medium on which a toner image is fused by the fusing device.

The belt may be configured to move past the first and second rollers in a tensionless state.

The fusing device may further comprise a belt guide disposed inside the loop of the belt. The belt guide may be spaced apart from the first roller to support a section of the belt that is away from the first roller.

The belt guide may be configured to support the belt in such a manner as to reduce a lateral movement of the belt in a direction of a width of the belt so as to mitigate skewing of the belt.

The fusing device may further comprise a third roller disposed inside the loop at a location spaced apart from the first roller. The third roller may support a section of the belt that is away from the first roller in such a manner to maintain the belt in a tensioned state.

The fusing device may further comprise a second heat source disposed inside the third roller.

According to another aspect, an image forming apparatus may be provide to include a print unit and a fusing device. The print unit may be configured to develop an electrostatic latent image using a developing agent to produce a visible developed image, and to transfer the visible developed image onto a printing medium. The fusing device may be configured to fix the visible developed image on the printing medium. The fusing device may comprise a belt having a closed loop configuration; a first roller rotatably disposed inside a loop defined by the belt, the first roller having a metallic layer formed on an outer circumferential surface thereof; a second roller rotatably disposed outside the loop, the first and second rollers each being in a pressing contact with a portion of the belt that passes therebetween; and a first heat source disposed inside the belt.

According to yet another aspect, a fusing device usable in an image forming apparatus for fixing a toner image onto a printing medium may comprise a belt defining a closed loop; a first member disposed inside the loop defined by the belt, the first member including a heat absorbent material; and a second member disposed outside the loop, the first and second members each being in a pressing contact with a portion of the belt that passes therebetween so as to cause a fusing nip to form between the portion of the belt that passes between the first and second members and the second member, the first member being configured to receive heat from a heat source, and to direct the received heat toward the fusing nip.

BRIEF DESCRIPTION OF THE DRAWINGS

Various features and advantages of the present disclosure will become more apparent by describing several embodiments thereof with reference to the attached drawings, in which:

FIG. **1** illustrates an implementation of an image forming apparatus according to an embodiment of the present disclosure;

FIG. **2** illustrates an implementation of a fusing device employed in the image forming apparatus of FIG. **1** according to an embodiment of the present disclosure;

FIG. **3** is a cross-sectional view of a fusing belt according to an embodiment of the present disclosure;

FIG. **4** is a cross-sectional view of a first roller according to an embodiment of the present disclosure;

FIG. **5** illustrates the arrangement of a belt guide according to an embodiment of the present disclosure;

FIG. **6** illustrates an implementation of a fusing device according to another embodiment of the present disclosure;

FIG. **7** illustrates an implementation of a fusing device according to another embodiment of the present disclosure; and

FIG. **8** illustrates an implementation of a fusing device according to another embodiment of the present disclosure.

DETAILED DESCRIPTION OF SEVERAL EMBODIMENTS

Hereinafter, several embodiments of a fusing device and an image forming apparatus employing the same will be described more fully with reference to the accompanying drawings.

FIG. **1** schematically illustrates an implementation of an image forming apparatus according to an embodiment of the present disclosure. FIG. **1** illustrates a print unit **100** configured to print an image on a printing medium (e.g., paper) according to an electro-photographic process, and a fusing device **300**. In one or more of the embodiments described herein, the image forming apparatus can be a dry type electro-photographic image forming apparatus configure to use a dry developing agent (hereinafter referred to as 'toner').

The print unit **100** can include an exposure unit **30**, a developing unit **10**, and a transfer unit **50**. To print a color image, the print unit **100** can include developing units **10**C, **10**M, **10**Y, and **10**K, which respectively contain cyan (C) toner, magenta (M) toner, yellow (Y) toner, and black (K) toner. The print unit **100** can include exposure units **30**C, **30**M, **30**Y, and **30**K respectively corresponding to the developing units **10**C, **10**M, **10**Y, and **10**K.

Each of the developing units **10**C, **10**M, **10**Y, **10**K can include a photosensitive drum **11**, which can be used as an image forming unit on which an electrostatic latent image can be formed, and a developing roller **12** configured to develop the electrostatic latent image. A charging bias can be applied to a charging roller **13** to charge the outer circumferential surface of the photosensitive drum **11** with a uniform electric potential. In some embodiments, a corona charger (not shown) can be used instead of the charging roller **13**. Toner can be supplied to the photosensitive drum **11** by transferring the toner attached to the outer circumferential surface of the developing roller **12**. To this end, a developing bias can be applied to the developing roller **12** to supply the toner to the photosensitive drum **11**. In each of the developing units **10**C, **10**M, **10**Y, and **10**K, there can be disposed a supply roller (not shown) configured to attach the toner contained in the corresponding developing unit to the developing roller **12**, a regulating unit (not shown) configured to regulate the amount of toner attached to the developing roller **12**, and an agitator (not shown) configured to transfer the toner contained in the corresponding developing unit to the supply roller and/or to the developing roller **12**. Each of the developing units **10**C, **10**M, **10**Y, and **10**K can include a cleaning blade (not shown) configured to remove the toner from the outer circumferential surface of the photosensitive drum **11** before charging the photosensitive drum **11**, and a receiving space (not shown) configured to contain the removed toner.

For example, the transfer unit **50** can include a paper conveyor belt **20** and transfer rollers **40**. The paper conveyor belt **20** can be disposed opposite (e.g., facing) the outer circumferential surface of the photosensitive drum **11** that is exposed outside of each of the developing units **10**C, **10**M, **10**Y, and **10**K. The paper conveyor belt **20** can move in a circular direction while being supported by multiple support rollers **21**, **22**, **23** and **24**. In one embodiment, the paper conveyor belt **20** can be disposed in a substantially vertical direction. The transfer rollers **40** can be arranged opposite to the photosensitive drums **11** of the respective developing units **10**C, **10**M, **10**Y, and **10**K, and the paper conveyor belt **20** can be positioned between the transfer rollers **40** and the photosensitive drums **11**. A transfer bias can be applied to the transfer roller **40**. The exposure units **30**C, **30**M, **30**Y, and **30**K can be configured to scan a light onto the photosensitive drums **11** of the respective developing units **10**C, **10**M, **10**Y, and **10**K. The light scanned by the exposure units **30**C, **30**M, **30**Y, and **30**K can correspond to C, M, Y, and K images, respectively. In one embodiment, laser scanning units (LSU) having a laser diode configured to be used as a light source can be used as the exposure units **30**C, **30**M, **30**Y, and **30**K.

A method of forming a color image by using such an image forming apparatus is described below.

Referring to FIG. **1**, the photosensitive drums **12** of the respective developing units **10**C, **10**M, **10**Y, and **10**K can be charged to a uniform electric potential by applying a charging bias to the charging roller **13**. The exposure units **30**C, **30**M, **30**Y, and **30**K can each scan lights that correspond to information of one of C, M, Y and K images onto the photosensitive drums **11** of their respective developing units **10**C, **10**M, **10**Y, and **10**K to produce an electrostatic latent image. A developing bias can be applied to the developing roller **12**. The toner can be transferred from the outer circumferential surface of the developing roller **12** to the electrostatic latent image such that C, M, Y and K toner images can be formed on the photosensitive drum **11** of the respective developing units **10**C, **10**M, **10**Y, and **10**K.

A printing medium, such as paper, can be fed from a cassette **120** by a pickup roller **121**. The paper can be directed toward the paper conveyor belt **20** via a feed roller **122**, and may adhere to a surface of the paper conveyor belt **20** by an electrostatic force. The paper can be fed at a speed that is substantially the same as the moving speed of the paper conveyor belt **20**.

In one example, the front end of the paper can arrive at a transfer nip when the front end of the C toner image formed on the outer circumferential surface of the photosensitive drum **11** of the developing unit **10**C arrives at the transfer nip facing the transfer roller **40**. When a transfer bias is applied to the transfer roller **40**, the C toner image is transferred from the photosensitive drum **11** to the paper. As the paper is fed, each of the remaining M, Y and K toner images formed on the photosensitive drum **11** of their respective developing units **10**M, **10**Y, and **10**K, can be sequentially transferred to the paper in such a manner that the toner images overlap each other on the paper, and form a color toner image on the paper.

The color toner image can be retained on the paper by an electrostatic force. A fusing unit **300** can be configured to fuse the color toner image to the paper by applying heat and pressure thereto. The paper with the fused color toner image can be discharged to a space outside of the image forming apparatus via a discharging roller **123**. In the above described embodiment, the toner images on the photosensitive drums **11** can be directly transferred to the paper without having to perform an intermediate transfer. In other embodiments, however, the toner images developed on the photosensitive drums **11** can be transferred to an intermediate medium (not shown) before being transferred to the paper.

The image forming apparatus can further include a scanner **200** configured to read image information from an original image. For example, the scanner **200** can be configured to read the image information from the original image by scanning light onto the original image and detecting the light reflected from the original image with a read unit **210**. The read unit **210** can be a contact type image sensor (CIS), a charge-coupled device (CCD), or other like device, for example. In one example, the scanner **200** can be a flat-bed type scanner in which the original image can be placed on a platen **220** and the read unit **210** can move in a sub-scanning direction. In another example, the scanner **200** can have a structure in which the read unit **210** can be in a fixed location and the original image can move in the sub-scanning direction. In yet another example, the scanner **200** can have a structure that combines at least some of the aspects of the above-described structures. The image information read by the scanner **200** can be transmitted to a communication device (not shown), such as universal serial bus (USB), for example, via a host (not shown). The image information read by the scanner **200** can be printed on the paper by the print unit **100**, and thus, the image forming apparatus can function as a copier. The image forming apparatus can include a line controller (not shown) so that the image forming apparatus can function as a facsimile and be configured to transmit the image information scanned from the original image via a public line, for example.

In one embodiment, the image forming apparatus can be a single-path type color image forming apparatus. The image forming apparatus, however, need not be so limited. In another embodiment, the image forming apparatus can be a multi-path color image forming apparatus. In yet another embodiment, the image forming apparatus can be a monochromatic image forming apparatus.

FIG. **2** illustrates an implementation of a fusing device **300** usable in the image forming apparatus of FIG. **1** according to an embodiment of the present disclosure. Referring to FIG. **2**, the fusing device **300** can include a fusing belt **310**, first and second rollers **320** and **330**, and a first heat source **341**. The first roller **320** can be disposed or located inside the fusing belt **310**. The fusing belt **310** can have a closed loop structure or configuration. The second roller **330** can be disposed outside the fusing belt **310**. To form a fusing nip **301**, the first and second rollers **320** and **330** can be configured to be in a pressing engagement with each other in such a manner as to rotate together while having the fusing belt **310** placed therebetween. An elastic unit **350** (e.g., spring) can be configured to apply an elastic force to the first roller **320** and/or to the second roller **330** along a direction in which the first and second rollers **320** and **330** are engaged with each other.

As illustrated in FIG. **3**, the fusing belt **310** can include an elastic layer **312** and a separation layer **313** formed on a surface of a substrate **311**. The separation layer **313** can be made of a perfluoroalkoxy (PFA) copolymer, for example. In the substrate **311**, a black coating layer **314** can be formed to absorb radiant heat generated by the first heat source **341**. The substrate **311** can be a thin metallic layer such as a thin stainless steel layer, for example. The thickness of the substrate **311** can be determined so that a portion of the fusing belt **310** can be elastically deformed near the fusing nip **301**, and so that it can be restored to its original state when that portion of the fusing belt **310** moves away from the fusing nip **301**. The substrate **311** can be a thin layer made of stainless steel and having a thickness of about 35 microns, for example. The elastic layer **312** can be a rubber layer having a thickness of about 200 microns, for example. The thicknesses and/or composition of the various layers of the fusing belt **310** need not be limited to the examples provided above.

As illustrated in FIG. **4**, the first roller **320** can include a thin metallic layer **324**. The thin metallic layer **324** can be an outermost layer constituting the first roller **320**. An elastic layer **322** can be formed between a core **321** and the thin metallic layer **324**. When the first and second rollers **320** and **330** are engaged with each other, the elastic layer **322** can be deformed to allow the fuse nip **301** to form. An insulating layer **323** can be formed between the elastic layer **322** and the thin metallic layer **324** to prevent thermal energy, which is generated by the first heat source **341** and absorbed by the thin metallic layer **324**, from being delivered to the elastic layer **322**. In addition to preventing the surface of the elastic layer **322** from being rapidly overheated by the radiant heat generated by the first heat source **341**, the insulating layer **322** can also allow the thermal energy absorbed by the thin metallic layer **324** to be efficiently delivered to the fusing nip **301**. The thickness of the thin metallic layer **324** can be determined so that the thin metallic layer **324** can be elastically deformed to create a fusing nip **301** of sufficient size, and so that the thin metallic layer **324** can be restored to its original state when the first roller **320** moves away from the fusing nip **301**. The thin metallic layer **324** can be a thin layer made of stainless steel having a thickness of about 35 microns, for example. The insulating layer **323** can be a mica layer having a thickness of about 100 microns, for example. The thicknesses and/or composition of the various layers of the first roller **320** need not be limited to the examples provided above.

The second roller **330** can be a metallic roller, for example. The second roller **330** can be fabricated by, for example, forming an elastic layer on a metallic roller.

The first heat source **341** can be disposed inside the fusing belt **310**. Heat generated by the first heat source **341** can be delivered to the fusing belt **310** and to the first roller **320**. The heat generated by the first heat source **341** is mostly delivered to the substrate **311** of the fusing belt **310** and to the thin metallic layer **324** of the first roller **320**. Various heating devices (e.g., a heating lamp, such as, e.g., a halogen lamp, induction heater, or the like) can be used as the first heat source **341**. Although the embodiment shown in FIG. **2** illustrates one first heat source **341** disposed inside the fusing belt **310**, other embodiments can have two or more first heat sources **341** disposed inside the fusing belt **310** or elsewhere.

A front surface of the printing medium P having the toner image can be in contact with the fusing belt **310** and a back surface of the printing medium P can be supported by the second roller **330**. The temperature of the fusing belt **310** can increase because the fusing belt **310** can be directly heated by the first heat source **341**, and can also be indirectly heated by the first roller **320** because of the thermal energy absorbed by the first roller **320** from the first heat source **341**. The toner image can be fused to the printing medium P because of the temperature of the fusing belt **310**. Moreover, the fused toner image can be pressed so that it attaches to the printing medium P by having the first and second rollers **320** and **330** engaged with each other. As a result of the application of heat and pressure, the toner image can be fused to the printing medium P.

According to some embodiments, a nip forming unit (not shown) can be employed instead of the first roller **320**. The nip forming unit can be fixedly disposed inside the fusing belt **310**, and can be configured to apply pressure to the second roller **330**. When a nip forming unit is used, however, a slip can occur between the second roller **330** and the fusing belt **310**. Such a slip can occur, for example, during an initial stage when the second roller **330** begins to rotate. To prevent the slip between the fusing belt **310** and the second roller **330**, a higher amount of pressure than a typical amount of pressure can be applied to the second roller **330**. Because a slip occurs between the fusing belt **310** and the nip forming unit to allow the fusing belt **310** to move, it may be difficult to apply such a higher pressure to the nip forming unit or to the second roller **330**. Thus, a lubricant can be used on the surface of the nip forming unit or the fusing belt **310** to allow the fusing belt **310** to move.

Because the fusing belt **310** is moved by the first and second rollers **320** and **330** when rotating together while engaged with each other, a slip is less likely to occur between the fusing belt **310** and the first and second rollers **320** and **330**. Thus, the fusing belt **310** can move stably. Moreover, because the first roller **320** rotates, a higher pressure can be applied to the first roller **320** and/or to the second roller **330** to allow a stable fusing nip **301** to be formed. Because the first roller **320** rotates, no lubricant may need to be applied between the first roller **320** and the fusing belt **310**.

The thin metallic layer **324** of the first roller **320** allows the heat generated by the first heat source **341** to be rapidly absorbed and delivered to the fusing nip **301**. In other words, because of its small thickness, the thin metallic layer **324** can be rapidly heated by thermal energy generated by the first heat source **341**. The absorbed thermal energy can be quickly delivered to the fusing nip **301** by heat conduction performed by the thin metallic layer **324** and the rotation of the first roller **320**. Moreover, when the insulating layer **323** is formed between the thin metallic layer **324** and the elastic layer **322**, the thermal energy can be more effectively delivered to the fusing nip **301** by reducing thermal losses that occur from the thin metallic layer **324** to the elastic layer **322**. The substrate **311** of the fusing belt **310**, which is a thin metallic layer, can also allow the heat from the first heat source **341** to be rapidly absorbed and delivered to the fusing nip **301** in a manner that is substantially similar to the manner in which heat is absorbed and delivered by the thin metallic layer **324** of the first roller **320**. The black coating layer **314** of the fusing belt **310** is configured to allow the thermal energy generated by the first heat source **341** to be more effectively absorbed. As described above, in the fusing device **300**, the temperature of the fusing nip **301** can be rapidly increased to a fusing temperature and maintained at the fusing temperature by effectively absorbing and delivering heat. According to an experimental example, a time needed to increase the temperature of an outer surface of the fusing belt **310** from about 10 degrees Celsius (° C.) to about 180° C. is about half the time that is required by a conventional fusing device. According to another experimental example, an upper limit of a printing speed that provides a fusing quality of about 90% is about 38 pages-per-minute (ppm); which is a higher printing speed than that achievable when a conventional fusing device is used. The above mentioned experiments were conducted to analyze the heating time and/or printing speed of various embodiments. The operation of the embodiments described herein need not be limited to achieving the above mentioned heating time and/or printing speed.

Referring to FIGS. **2** and **5**, a belt guide **360** is illustrated. The fusing belt **310** can be moved in a tensionless state. That is, the fusing belt **310** can be moved by the rotation of the first and second rollers **320** and **330** without having a tensile force applied to the fusing belt **310**. The belt guide **360** can be configured to prevent the fusing belt **310** from hanging down. Thus, the belt guide **360** can loosely support the fusing belt **310** so that a tensile force need not be applied to the fusing belt **310**. Moreover, the belt guide **360** can be configured to guide an end of the fusing belt **310** in a direction of the width of the fusing belt **310** to prevent the fusing belt **310** from skewing. The belt guide **360** can be configured to guide both ends of the fusing belt **310** instead of the entire width of the fusing belt **310**. A loss of heat produced by the first heat source **341** via the belt guide **360** can be minimized by using the belt guide **360** having a small size that is sufficient to guide the fusing belt **310**.

FIG. **6** illustrates an implementation of a fusing device **300***a* according to another embodiment of the present disclosure. The fusing device **300***a* can be substantially the same as the fusing device **300** illustrated in FIG. **2**, and may additionally have a second heat source **342** disposed within a first roller **320***a*. In this embodiment, a core **321***a* of the first roller **320***a* can have a hollow inner portion (e.g., hollow pipe) such that the second heat source **342** can be disposed inside the first roller **320***a*. An elastic layer **322** and a thin metallic layer **324** can be formed outside the core **321***a*. Various heating devices, such as a heating lamp (e.g., halogen lamp) or an induction heater, for example, can be used as the second heat source **342**.

FIG. **7** illustrates an implementation of a fusing device **300***b* according to another embodiment of the present disclosure. The fusing device **300***b* can be substantially the same as the fusing device **300** illustrated in FIG. **2**, and can be configured to have the fusing belt **310** moving in a tensioned state. Instead of using the belt guide **360** as illustrated in FIG. **6**, a support roller **360***a* configured to support the fusing belt **310** in cooperation with the first roller **320** in a tensioned state can be disposed inside the fusing belt **310**. In another embodiment, the first roller **320***a* illustrated in FIG. **6** can be used in the fusing device **300***b* instead of the first roller **320** illustrated in FIG. **2**.

FIG. **8** illustrates an implementation of a fusing device **300***c* according to yet another embodiment of the present disclosure. The fusing device **300***c* can be substantially the same as the fusing device **300***b* illustrated in FIG. **7**, and can have a support roller **360***b* (e.g., a hollow pipe) instead of the support roller **360***a* illustrated in FIG. **7**. A third heat source **343** can be disposed within the support roller **360***b*. Various heating devices, such as a heating lamp (e.g., a halogen lamp) or an induction heater, for example, can be used as the third heat source **343**. The support roller **360***b* can have substantially the same configuration as the first roller **320***a* illustrated in FIG. **6**. In another embodiment, the first roller **320***a* having the second heat source **342**, and as illustrated in FIG. **6**, can be used in the fusing device **300***c* instead of the first roller **320** illustrated in FIG. **2**.

While the present disclosure has been described with reference to several embodiments, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present disclosure as defined by the following claims.

What is claimed is:

1. A fusing device, comprising:

a belt defining a closed loop and comprising a black coating layer disposed on an inner surface of the loop to absorb radiant heat;

a first roller rotatably disposed inside the loop, the first roller comprising a metallic layer disposed on an outer circumferential surface thereof;

a second roller rotatably disposed outside the loop, the first and second rollers each being in a pressing contact with a portion of the belt that passes therebetween; and

a first heat source disposed inside the loop and outside of the first roller, to radiate heat onto the black coating layer of the belt and the metallic layer of the first roller.

2. The fusing device of claim 1, wherein the first roller comprises:

a core; and

an elastic layer disposed between the core and the metallic layer.

3. The fusing device of claim 2, wherein the first roller further comprises an insulating layer disposed between the elastic layer and the metallic layer.

4. The fusing device of claim 2, wherein:

the core has a hollow inner portion; and

the fusing device further comprises a second heat source disposed inside the hollow inner portion of the core.

5. The fusing device of claim 1, wherein the belt comprises:

a substrate disposed around the coating layer and comprising a metallic layer; and

an elastic layer disposed around the substrate.

6. The fusing device of claim 5, wherein the belt comprises a separation layer disposed on around the elastic layer, the separation layer to promote the separation of the belt from a printing medium on which a toner image is fused by the fusing device.

7. The fusing device of claim 1, wherein the belt is configured to move past the first and second rollers in a tensionless state.

8. The fusing device of claim 7, further comprising:

a belt guide disposed inside the loop to support a section of the belt.

9. The fusing device of claim 8, wherein the belt guide is configured to mitigate skewing of the belt.

10. The fusing device of claim 1, further comprising:

a third roller disposed inside the loop to maintain the belt in a tensioned state.

11. The fusing device of claim 10, further comprising:

a second heat source disposed inside the third roller.

12. An image forming apparatus, comprising:

a print unit configured to develop an electrostatic latent image using a developing agent to produce a visible developed image, the print unit being configured to transfer the visible developed image onto a printing medium; and

a fusing device configured to fix the visible developed image on the printing medium, the fusing device comprising:

a belt defining a closed loop and comprising a black coating layer disposed on an inner surface of the loop to absorb radiant heat;

a first roller rotatably disposed inside the loop and comprising a metallic layer formed on the outer surface thereof;

a second roller rotatably disposed outside the loop, the first and second rollers each being in a pressing contact with a portion of the belt that passes therebetween; and

a first heat source disposed inside the loop and outside of the first roller, to radiate heat onto the black coating layer of the belt and the metallic layer of the first roller.

13. The image forming apparatus claim 12, wherein the first roller comprises:

a core; and

an elastic layer disposed between the core and the metallic layer.

14. The image forming apparatus claim 13, wherein the first roller further comprises an insulating layer disposed between the elastic layer and the metallic layer.

15. The image forming apparatus claim 13, wherein:

the core has a hollow inner portion; and

the fusing device further comprises a second heat source disposed inside the hollow inner portion of the core.

16. The image forming apparatus claim 12, wherein the belt comprises:

a substrate comprising a metallic layer; and

an elastic layer; and

a substrate disposed between the black coating layer and the elastic layer and comprising a metallic layer.

17. The image forming apparatus claim 16, wherein the belt comprises a separation layer disposed around the elastic layer to promote separation of the belt from a printing medium.

18. The image forming apparatus claim 12, wherein the belt is configured to move past the first and second rollers in a tensionless state.

19. The image forming apparatus claim 18, wherein the fusing device further comprises:

a belt guide disposed inside the loop to support a section of the belt.

20. The image forming apparatus claim 19, wherein the belt guide is configured to mitigate skewing of the belt.

21. The image forming apparatus claim 18, wherein the fusing device further comprises:

a third roller disposed inside the loop to apply tension to the belt.

22. The image forming apparatus claim 21, wherein the fusing device further comprises:

a second heat source disposed inside the third roller.

23. A fusing device usable in an image forming apparatus for fixing a toner image onto a printing medium, comprising:

a belt defining a closed loop;

a first member disposed inside the loop and comprising:

a solid non-hollow core;

a metallic layer disposed around the solid non-hollow core; and

an insulating layer disposed between the solid non-hollow core and the metallic layer;

a second member disposed outside the loop, the first and second members each being in a pressing contact with a portion of the belt that passes therebetween so as to cause a fusing nip to form between the portion of the belt that passes between the first and second members; and

a heat source disposed inside of the loop and outside of the first member, to radiate heat onto the metallic layer of the first member and the belt.

24. A fusing device comprising:

a belt defining a closed loop;

a first roller rotatably disposed inside of the loop, the first roller comprising a metallic layer disposed on an outer circumferential surface thereof;

a second roller rotatably disposed outside of the loop, the first and second rollers being in pressing contact with a portion of the belt disposed therebetween; and

a first heat source disposed inside of the belt and outside of the first roller, to radiate heat to the metallic layer.

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